Physics Lib
Farm

THE JOURNAL OF CHEMICAL PHYSICS VOLUME 14, NUMBER 12 DECEMBER, 1946

CONTENTS

JANUARY, 1946

Thermal and Photochemical Decomposition of Gaseous Aluminum Trimethyl . . . . . LOURDU M. YEDDANAPALLI AND CLARENCE C. SCHUBERT 1

Motions of Molecules in Condensed Systems: I. Selection Rules, Relative Intensities, and Orientation Effects for Raman and Infra-Red Lines . . . . . RALPH S. HALFORD 8

Kinetics of OH Radicals as Determined by Their Absorption Spectrum. VI. Attempt to Trace OH Radicals in the Thermal Hydrogen-Oxygen Reaction . . . . . O. OLDENBERG, J. E. MORRIS, C. T. MORROW, E. G. SCHNEIDER, AND H. S. SOMMERS, JR. 16

Electric Circuit Models for the Vibration Spectrum of Polyatomic Molecules . GABRIEL KRON 19

Network Analyzer Tests of Equivalent Circuits of Vibrating Polyatomic Molecules . . . . . G. K. CARTER AND G. KRON 32

Asymmetric Rotor. III. Punched-Card Methods of Constructing Band Spectra . . . . . GILBERT W. KING, PAUL C. CROSS, AND GEORGE B. THOMAS 35

Light Scattering of High Polymer Solutions . . . . . JURG WASER, RICHARD M. BADGER, AND VERNER SCHOMAKER 43

Letters to the Editor:

Theory of Multimolecular Adsorption from a Mixture of Gases . . . . . TERRELL L. HILL 46
General Theory of the Reaction Loci in Emulsion Polymerization. II . . . . WILLIAM D. HARKINS 47
Density and Thermal Expansion of Liquid Phosgene . . . . . C. N. DAVIES 48
Statistical Mechanics of Linear Association Equilibria . . . . . PAUL J. FLORY 49

FEBRUARY, 1946

Elastic Loss and Relaxation Times in Cross-Linked Polymers . . . . . JOHN G. KIRKWOOD 51

Mercury Photosensitized Reactions of Propylene and Isoprene . . . . . H. E. GUNNING AND E. W. R. STEACIE 57

Classical Models and Many-Electron Atoms . . . . . MELVIN A. COOK 62

Thermodynamic Properties of Gaseous 1,3-Butadiene and the Normal Butenes above 25°C. Equilibria in the System 1,3-Butadiene, *n*-Butenes, and *n*-Butane . . . . . JOHN G. ASTON, GEORGE SZASZ, HAROLD W. WOOLLEY, AND FERDINAND G. BRICKWEDDE 67

New Approach to the Theory of Relaxing Polymeric Media . M. S. GREEN AND A. V. TOBOLSKY 80

Stress-Time-Temperature Relations in Polysulfide Rubbers . M. D. STERN AND A. V. TOBOLSKY 93

Near Ultraviolet Absorption of Pyridine Vapor . . . . H. SPONER AND HILDEGARD STÜCKLEN 101

Letters to the Editor:

Latin American Collaboration . . . . . HARLOW SHAPLEY 113
Creep under Constant Load in Tension . . . . . PAUL J. BLATZ AND ARTHUR V. TOBOLSKY 113
Stearic Strain in Compounds with Tertiary Butyl Groups; Steric Strain in Polyisobutylene . . . . . HERBERT C. BROWN AND GERALDINE K. BARBARAS 114
Absorption Spectrum of Metal-Ammonia Solutions . . . . . RICHARD A. OGG, JR. 114
Copolymerization of Systems Containing Three Components . . . . . TURNER ALFREY AND GEORGE GOLDFINGER 115

MARCH, 1946

Surfaces of Solids. XV. First-Order Phase Changes of Adsorbed Films on the Surfaces of Solids: The Film of *n*-Heptane on Ferric Oxide . . . . . GEORGE JURA, EDWARD H. LOESER, PAUL R. BASFORD, AND WILLIAM D. HARKINS 117
Absorption Spectrum of Fluorbenzene in the Near Ultraviolet . . . . . S. H. WOLLMAN 123
Chemical Forms Assumed by C^{14} Produced by Neutron Irradiation of Nitrogenous Substances . . . . . P. E. YANKWICH, G. K. ROLLEFSON, AND T. H. NORRIS 131
Motions of Molecules in Condensed Systems. II. The Infra-Red Spectra for Benzene Solid, Liquid, and Vapor in the Range from 3 to 16.7μ . . . . . RALPH S. HALFORD AND OLIVER A. SCHAEFFER 141
Heat-Capacity Lag in Gas Dynamics . . . . . ARTHUR KANTROWITZ 150
Application of the Methods of Molecular Distribution to Solutions of Large Molecules . . . . . BRUNO H. ZIMM 164
Statistical Mechanical Theory of Transport Processes. I. General Theory . JOHN G. KIRKWOOD 180
Note on the Theory of Diffusion Controlled Reactions with Application to the Quenching of Fluorescence . . . . . ELLIOTT W. MONTROLL 202
Predissociations in Nitric Oxide . . . . . P. J. FLORY AND H. L. JOHNSTON 212

Letters to the Editor:

Loci of Emulsion Polymerization: The Diffusion of Organic Molecules from Emulsion Droplets through an Aqueous Phase into Soap Micelles . . . . . RICHARD S. STEARNS AND WILLIAM D. HARKINS 214
Loci of Emulsion Polymerization: Diffusion of Organic Molecules from Emulsion Droplets through an Aqueous Phase into Polymer Latex Particles . . . . . WILLIAM D. HARKINS AND RICHARD S. STEARNS 215
Critical Concentration for the Formation of Micelles as Indicated by the Absorption Spectrum of a Cyanine Dye . . MYRON L. CORRIN, HOWARD B. KLEVENS, AND WILLIAM D. HARKINS 216
Estimation of the Surface Area of Solid Particles . . . . . HANS M. CASSEL 217

APRIL, 1946

Improved Hot Wire Cell for Accurate Measurements of Thermal Conductivities of Gases over a Wide Temperature Range. Results with Air between 87° and 375°K . . . . . WILLIAM J. TAYLOR AND HERRICK L. JOHNSTON 219
Thermal Conductivities of Eight Common Gases between 80° and 380°K . . . . . HERRICK L. JOHNSTON AND EDWARD R. GRILLY 233
Energy Levels and Thermodynamic Functions for Molecules with Internal Rotation. II. Unsymmetrical Tops Attached to a Rigid Frame . . . . . KENNETH S. PITZER 239
On the Diffusion of Vapors through Polymers . . . . . PAUL DOTY 244
Electrical Potential at the Interface between Vitreous Silica and Solutions of Barium Chloride . . . . . LLOYD A. WOOD AND LAWRENCE B. ROBINSON 251
Test of Langmuir's Interpretation of the Jones-Ray Effect . . . . . LLOYD A. WOOD AND LAWRENCE B. ROBINSON 258
Statistical Mechanics of Multimolecular Adsorption. I. . . . . . TERRELL L. HILL 263
Theory of Multimolecular Adsorption from a Mixture of Gases . . . . . TERRELL L. HILL 268
On Phase Changes of Bose-Einstein Fluid Models . . . . . LOUIS GOLDSTEIN 276
Non-Planar Vibrations of Benzene . . . . FOIL A. MILLER AND BRYCE L. CRAWFORD, JR. 282
Infra-Red Spectra of *p*-Benzene-d_2 and *p*-Benzene-d_4 . . . . . FOIL A. MILLER AND BRYCE L. CRAWFORD, JR. 292

Letters to the Editor:

On the Force Constants of the XY_2 Molecule . . . . . DELIA M. SIMPSON 294
Comment on "On the Force Constants of the XY_2 Molecule" . GEO. GLOCKLER AND JO-YUN TUNG 294
Photoelectric Effect in Metal-Ammonia Solutions . . . . . RICHARD A. OGG, JR. 295

MAY, 1946

Scattering of Electrons by Hydrocarbon Films . . . . . J. KARLE 297
Relation between Bond Force Constants, Bond Orders, Bond Lengths, and the Electronegativities of the Bonded Atoms . . . . . WALTER GORDY 305
Thermodynamic Properties and Potential Energy of Solid Argon. II . . . . . O. K. RICE 321
Thermodynamic Properties of Liquid Argon . . . . . O. K. RICE 324
Pressure Dependence of Accommodation Coefficients . . . . . I. AMDUR 339
Theory of the Non-Tetrahedral Carbon Atom . . . . . GEORGE H. DUFFEY 342
Surfaces of Solids. XVII. A First- and a Second-Order Phase Change in the Adsorbed Film of *n*-Heptane on Graphite . . . . . GEORGE JURA, WILLIAM D. HARKINS, AND EDWARD H. LOESER 344
Errata: Statistical Mechanics of Transport Processes. I. General Theory . JOHN G. KIRKWOOD 347

Letters to the Editor:

On the Weak Associations in Water and in Aniline . . . . . R. PARSHAD 348
Note on Communal Entropy. Remarks on a Paper by Henry S. Frank . . . . . O. K. RICE 348
Postscript to the Foregoing Note by O. K. Rice . . . . . HENRY S. FRANK 350
Tetrahedral P_4 Molecules . . . . . JAMES R. ARNOLD 351
Ultra-High Frequency Denaturation of Proteins . . . . . GEORGE A. BOYD 351
Recognition of Phase Transitions in Adsorbed Films on Solids . . . . . D. H. BANGHAM 352
Aggregational States in Adsorbed Films on Incompletely Wettable Solid Surfaces . D. H. BANGHAM 352
Sedimentation Equilibria of Polydisperse Non-Ideal Solutes . . . . . MICHAEL WALES, MARGARET BENDER, J. W. WILLIAMS, AND ROSWELL H. EWART 353

JUNE, 1946

Thallous Sulfide Photo-Conductive Cells. I. Experimental Investigation . . . . . A. VON HIPPEL, F. G. CHESLEY, H. S. DENMARK, P. B. ULIN, AND E. S. RITTNER 355
Thallous Sulfide Photo-Conductive Cells. II. Theoretical Discussion . . . . . A. VON HIPPEL AND E. S. RITTNER 370
Notes on the Infra-Red Spectrum and Molecular Structure of Ozone . . . . . ARTHUR ABEL AND DAVID M. DENNISON 379
Studies on Glass. XVIII. The Heats of Solution of Crystalline and Glassy Glucose; the Heat of Mutarotation of α-Glucose . . . . . ROBERT D. ROWE AND GEORGE S. PARKS 383
Relation between Internuclear Distances and Potential Barriers of Methyl Groups . . . . . F. A. FRENCH AND R. S. RASMUSSEN 389
Force Constant of the Association Bond in the Formic and Acetic Acid Dimers . J. O. HALFORD 395

Letters to the Editor:

New Units for the Measurement of Radioactivity . . . . . E. U. CONDON AND L. F. CURTISS 399
Electron Affinity of Amide Radical and the Chemical Stability of Metal-Ammonia Solutions . . . . . RICHARD A. OGG, JR. 399

JULY, 1946

Efficiency of the Electrolytic Separation of Potassium Isotopes . . . . DWIGHT A. HUTCHISON 401
X-Ray Diffraction Investigation of the Thermal Decomposition of Silver Oxalate . . . . . R. L. GRIFFITH 408
Behavior of Macromolecules in Inhomogeneous Flow . . . . . H. A. KRAMERS 415
Conductometric Investigation of Electrolytic Solutions in Hydrocarbons . ANDREW GEMANT 424
Accommodation Coefficients for Heat Conduction Between Gas and Bright Platinum, for Nine Gases between 80°K (or Their Boiling Points) and 380°K . . . . . EDWARD R. GRILLY, WILLIAM J. TAYLOR, AND HERRICK L. JOHNSTON 435
Statistical Mechanics of Multimolecular Adsorption. II. Localized and Mobile Adsorption and Absorption . . . . . TERRELL L. HILL 441
Time-Dependence of Boundary Tensions of Solutions. I. The Role of Diffusion in Time-Effects . . . . . A. F. H. WARD AND L. TORDAI 453

Letters to the Editor:

Jones-Ray Effect, Wettability, and Zeta-Potential . . . . . HANS M. CASSEL 462
Note on the Multi-Layer Postulate of Eversole and Lahr . . . . . G. A. H. ELTON 463
Bond Hybridization in the Non-Tetrahedral Carbon Atom . JOHN E. KILPATRICK AND RALPH SPITZER 463
Electronic Shifts at Moderate Temperatures in Metals of Group VIII . W. R. HAM AND C. H. SAMANS 464
On Steric Effects . . . . . TERRELL L. HILL 465
Nitrogen and Stearic Acid Adsorption by Supported and Unsupported Catalysts . . . . . HERMAN E. RIES, JR., MARVIN F. L. JOHNSON, AND JOHN S. MELIK 465
Interpretation of Pressure Dependence of Accommodation Coefficients . . . . . J. L. MORRISON 466

AUGUST, 1946

Photochemical Polymerization of Butadiene . . . . . DAVID H. VOLMAN 467
Electron Diffraction Investigation of Dimethylketene Dimer . . . . . WILLIAM N. LIPSCOMB AND VERNER SCHOMAKER 475
Determination of Critical Concentrations for the Formation of Soap Micelles by the Spectral Behavior of Pinacyanol Chloride . . . . . M. L. CORRIN, H. B. KLEVENS, AND WILLIAM D. HARKINS 480
Free Radical Determination in Biacetyl Photolysis . . . . . RALPH G. ASCAH, MILTON BURTON, JOHN E. RICCI, AND THOMAS W. DAVIS 487
Crystal Structure of Synthetic Boehmite . . . . PAUL P. REICHERTZ AND W. JACQUE YOST 495
Liquid Association and Critical Temperature . . . . . FRANK BRESCIA 501

Letters to the Editor:

Synthetic Patterson Maps . . . . . A. D. BOOTH AND DOROTHY WRINCH 503
O—O Bond Energy in Hydrogen Peroxide . . . . . GEORGE GLOCKLER AND GEORGE MATLACK 504
Structure of Ozone . . . . . GEORGE GLOCKLER AND GEORGE MATLACK 505

SEPTEMBER, 1946

Heats of Solution of Hexamethylbenzene, Cetyl Alcohol, and Dicetyl in Related Liquids; Heats of Fusion by an Extrapolation Process . GEORGE S. PARKS AND ROBERT D. ROWE 507
Near Ultraviolet Absorption Spectrum of Toluene Vapor . . . . . NATHAN GINSBERG, W. W. ROBERTSON, AND F. A. MATSEN 511
Corresponding States in the Frozen Rare Gases . . . . . G. W. MURPHY AND O. K. RICE 518
On the Ultraviolet Absorption Spectrum of Ozone . . W. H. EBERHARDT AND W. SHAND, JR. 525
Force Constants of Ozone . . . . . GEORGE GLOCKLER AND GEORGE MATLACK 531
Reaction of Methyl Radicals with Butadiene and Isoprene . . . . . H. E. GUNNING AND E. W. R. STEACIE 534
Site of Reaction in Direct Photographic Development . . . . . T. H. JAMES 536
Mercury-Sensitized Reaction between Hydrogen and Nitrous Oxide . . . . . H. AUSTIN TAYLOR AND NORMAN ZWIEBEL 539
Mercury Photo-Sensitized Reactions of Isobutene . . H. E. GUNNING AND E. W. R. STEACIE 544
Mercury Photo-Sensitized Reactions of Diethyl Ether . . . . . B. DEB. DARWENT, E. W. R. STEACIE, AND A. F. VAN WINCKEL 551
Electron Diffraction Investigation of the Molecular Structure of Thioacetic Acid . . . . . WALTER GORDY 560
Note on the Conditions of Equilibrium for Systems of Many Constituents . . . . . STUART R. BRINKLEY, JR. 563

Letters to the Editor:

Tyndall Spectra, Their Significance and Application . . . WILFRIED HELLER AND ETIENNE VASSY 565
Determination of Particle Sizes from Tyndall Spectra . . . . . W. HELLER, H. B. KLEVENS, AND H. OPPENHEIMER 566
Spectrophotometric Studies on Solubilization of Hydrocarbons . . W. HELLER AND H. B. KLEVENS 567
Refractive Indices of Soaps and Detergents . . . . . H. B. KLEVENS 567
On the Dissociation Energies CO, N_2, NO, and CN . . . . . J. G. VALATIN 568
Crystal Structure of Polonium . . . . . WILLIAM H. BEAMER AND CHARLES R. MAXWELL 569
Superficial Density of the Energy of Natural Vibrations . . . A. BRAGER AND A. SCHUCHOWITZKY 569
Upper and Lower Bounds to Rayleigh's Frequency for a Vibrating System . . WILLIAM J. TAYLOR 570
Preparation of Mixed Thallium Bromide-Iodide for Infra-Red Transmissions . . . . . O. F. TUTTLE AND P. H. EGLI 571

OCTOBER, 1946

Intensities of Electronic Transitions in Ammonia . ROBERT J. THOMPSON AND A. B. F. DUNCAN 573
Experimental Determination of the Intensities of Infra-Red Absorption Bands. I. Theory of the Method . . . . . E. BRIGHT WILSON, JR. AND A. J. WELLS 578
Mercury Photosensitized Reactions of 1-Butene and 2-Butene . . . . . H. E. GUNNING AND E. W. R. STEACIE 581
Bending Force Constants for Halogenated Ethylenes . KENNETH S. PITZER AND N. K. FREEMAN 586
Differential Entropy of Dilution in Aqueous Solutions of Amino Acids . . . A. L. ROBINSON 588
Notes on the Rate Process Theory of Flow . . . . . A. BONDI 591
Ultrasonic Propagation in Liquids: I. Application of Pulse Technique to Velocity and Absorption Measurements at 15 Megacycles . . . . . J. R. PELLAM AND J. K. GALT 608
Ultrasonic Propagation in Liquids: II. Theoretical Study of the Free Volume Model of the Liquid State . . . . . CHARLES KITTEL 614
Theoretical Evaluation of Normal Frequencies of Vibration of the Isomeric Octanes . . . . . CHARLES O. AHONEN 625
Intrinsic Viscosity of Polymer Solutions . . . . . P. DEBYE 636

Letters to the Editor:

Effect of Solvents on the Critical Concentration for Micelle Formation of Cationic Soaps . . . . . M. L. CORRIN AND WILLIAM D. HARKINS 640
Determination of Critical Concentrations for Micelle Formation in Solutions of Cationic Soaps by Changes in the Color and Fluorescence of Dyes . M. L. CORRIN AND WILLIAM D. HARKINS 641
On the Structure of Ozone . . . . . W. H. EBERHARDT 641
Adsorption Isotherms for Hydrogen-Bonded Liquids on Charcoal . D. H. VOLMAN AND I. M. KLOTZ 642

NOVEMBER, 1946

Some Thermodynamic Constants for the Solution Processes of Atoms in Metallic Solvents . . . . . SHENG-NIEN WANG 643
Use of Punched Cards in Molecular Structure Determinations. I. Crystal Structure Calculations . . . . . P. A. SHAFFER, JR., VERNER SCHOMAKER, AND LINUS PAULING 648
Use of Punched Cards in Molecular Structure Determinations. II. Electron Diffraction Calculations . . . . . P. A. SHAFFER, JR., VERNER SCHOMAKER, AND LINUS PAULING 659
Rotational Structure of Some Electronic Bands of Chlorine Dioxide . . . . . JESSE B. COON 665
Erratum: "Note on the Conditions of Equilibrium for Systems of Many Constituents" . . . . . STUART R. BRINKLEY, JR. 686
Determination of Polymeric Molecular Weights by Light Scattering in Solvent-Precipitant Systems . . . . . R. H. EWART, C. P. ROE, P. DEBYE, AND J. R. MCCARTNEY 687
Simple Method of Obtaining a Particle Mass Distribution by Inverting the X-Ray Intensity Scattered at Small Angles . . . . . L. C. ROESS 695

Letters to the Editor:

Geometry of the Molecules CH_3Cl and CH_3Br . . . . . BÖRGE BAK 698
Adiabatic Compressibility of Liquids . . . . . M. RAMA RAO 699

DECEMBER, 1946

Mass Spectrometric Study of CH_3D. Dissociation Probabilities of C−H and C−D Bonds by Electron Impact . . . . . MARJORIE W. EVANS, NORMAN BAUER, AND J. Y. BEACH 701
Mercury Photo-Sensitized Reaction Between Hydrogen and Oxygen . . . DAVID H. VOLMAN 707
Investigation of Oxidation of Copper by Use of Radioactive Cu Tracer . . . . . J. BARDEEN, W. H. BRATTAIN, AND W. SHOCKLEY 714
Proposed Interpretation of the Zeta-Potential . . . . . LAWRENCE B. ROBINSON 721
Absorption of Water by Films of Cellophane and Polyvinyl Alcohol . . . . . E. CREUTZ AND ROBERT R. WILSON 725
Thermodynamic Properties of Gaseous Boron Triflouride, Boron Trichloride, and Boron Tribromide . . . . . HUGH M. SPENCER 729
Theory of the Racemization of Optically Active Derivatives of Diphenyl . . . . . F. H. WESTHEIMER AND JOSEPH E. MAYER 733
On the Equation of State for Gases at Extremely High Pressure . . . . . P. CALDIROLA 738

Letters to the Editor:

Critical Micelle Concentration of Anionic Soap Mixtures . . . . . H. B. KLEVENS 742
Relation Between Bond Multiplicity and Interatomic Distance . . . . . R. T. LAGEMANN 743

Author Index to Volume 14 744
Analytic Subject Index to Volume 14 748
Volume Table of Contents iii